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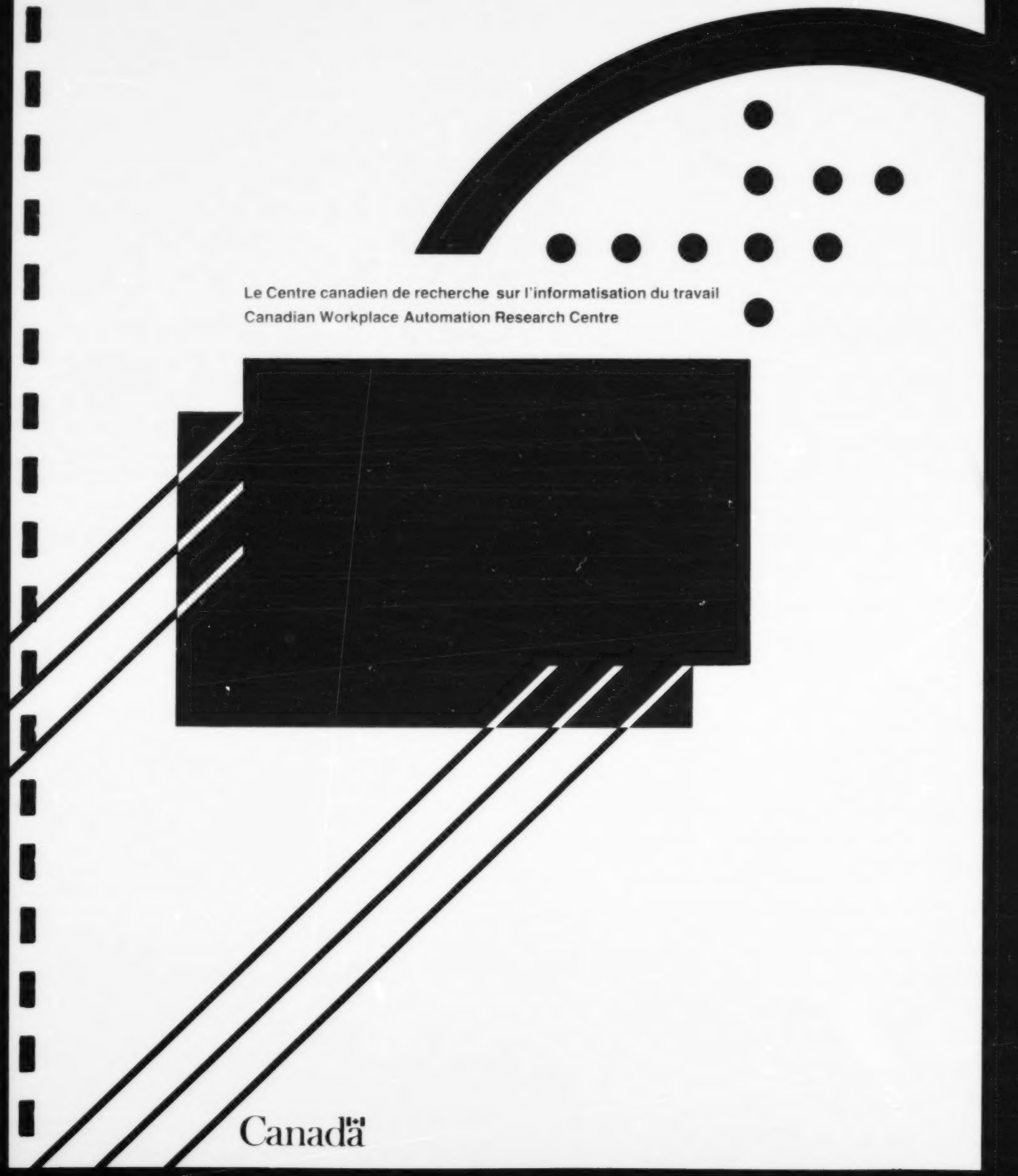

Le Centre canadien de recherche sur l'informatisation du travail
Canadian Workplace Automation Research Centre

Canada

Department of Communications of Canada
Canadian Workplace Automation Research Centre
Organizational Research Directorate

THE EFFECTS OF WORD PROCESSING AND AUTOMATED DATA ENTRY TECHNOLOGY ON THE QUANTITY AND QUALITY OF USERS' JOBS

SUMMARY

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et de la saisie de données informatisées
sur la quantité et la qualité
des emplois des utilisatrices

Résumé

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INTRODUCTION

While the technological revolution of the nineteenth century transformed the means of production of businesses in the secondary sector, the current micro-electronic revolution affects all sectors of the economy. Computers are invading sectors that traditionally have been relatively untouched by technological change. Some commercial, financial, administrative, accounting, and even design and management tasks are undergoing their first technological revolution as a result of the introduction of microcomputer-based tools in the tertiary sector.

The introduction of technological change in an organization may give rise to either resistance or co-operation among workers. People resist or accept technological changes depending on whether they see them as factors of personal loss or gain. During the Industrial Revolution of the nineteenth century, workers reacted negatively to the introduction of new mechanized means of production: looms were destroyed, factories were turned upside down and set on fire, and long strikes were held. Through economic crises and unrest, society was able to adapt and, in the long term, workers benefited from the economic growth caused by technical progress.

But what about the computer revolution? Research findings are contradictory. Some reports emphasize the positive effects: greater productivity, increased employment in some sectors of the economy, the elimination of certain tasks that threatened occupational health and safety, the enrichment of some occupations, and greater flexibility in organizing work. Others decry the elimination of some occupations and trades, technological unemployment, the increase in work-related stress resulting from too great a rate of production, deskilling, and the increase in the number of precarious jobs. These contradictory observations make it important to delve more deeply into the question and to identify not only the nature and severity of the different types of impact,

but especially their causes. It seems particularly important to find out and analyze employees' perceptions of the negative or positive effects of computer technology on the characteristics and conditions of their work.

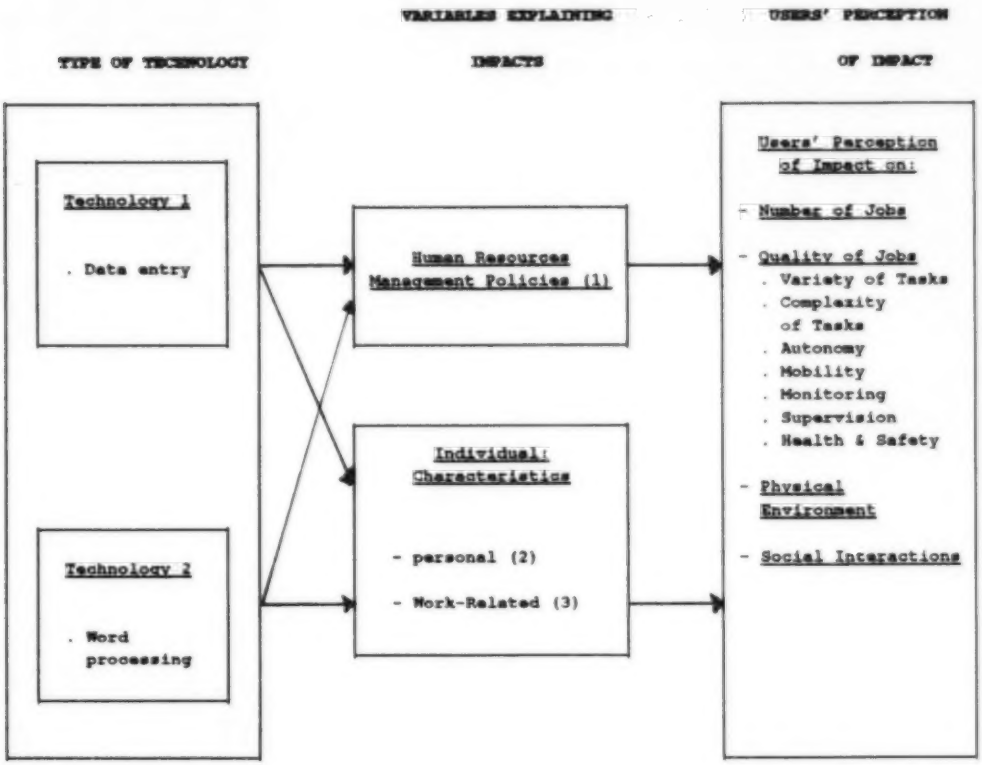
To shed more light on the situation in Quebec, research was conducted in six organizations located in the province: two hospitals, two private companies in the financial sector and two governmental agencies. The study had two objectives: (1) to measure the severity of certain socio-economic effects, and (2) to determine whether there is a link between them and management variables or individual characteristics of the workers, all of whom are women (see Table 1).

We attempted to discover and analyze the workers' perceptions of the positive or negative effects of data entry and word processing computer technology on the characteristics and conditions of their jobs. The data were gathered from 229 women working as data entry (DE) operators and 187 working as word processor (WP) operators (see Table 2).

TABLE 1

Framework of analysis

Relationship between Data Entry and Word Processing Technology and Their Impact on Users' Work and Working Conditions



(1) Human resources management policies considered:

- Human resources planning
- Involvement in making decisions concerning implementation
- Training
- Role of union
- Review of policies concerning task definition, monitoring of work, compensation, work organization, occupational health and safety.

(2) Personal characteristics considered: employees' attitude toward computer technology, age, experience on job, level of education, experience in using computer technology.

(3) Job-related characteristics considered: position held, type of work organization and types of work done.

TABLE 2

Distribution of Users by Organizations and Technology

ORGANIZATION \ TECHNOLOGY	WORD PROCESSING		DATA ENTRY		TOTAL	
	NO.	%	NO.	%	NO.	%
1	17	4.1	48	11.5	65	15.6
2	32	7.7	30	7.2	62	14.9
3	44	10.6	23	5.5	67	16.1
4	36	8.7	48	11.5	84	20.2
5	22	5.3	49	11.8	71	17.1
6	36	8.6	31	7.5	67	16.1
TOTAL	187	45.0	229	55.0	416	100.0

CHAPTER 1

METHODOLOGY

1.1 SAMPLE

Data were gathered in six large Quebec organizations, each of which employs over 500 people; the private companies have yearly budgets of about $200 million. To ensure confidentiality of data gathered at each organization, we have assigned them identification numbers:

Sector	Organization Numbers
Hospital	1 & 5
Financial	3 & 6
Governmental	2 & 4

1.1.1 Management of Computer Technology

Methods of managing the implementation of the two types computer technology under study differ very little from one organization to another or according to the type of technology (see Tables 3 and 4).

Generally speaking, automation of data entry and word processing began at least 10 years ago. It was decided upon by senior management because of pressure exerted by department heads or managers. With the exception of one establishment in the hospital sector, decisions on how to manage the introduction of word processing systems are the responsibility of a distinct administrative unit other than the one concerned with automated data entry. The objectives of the decision to automate were to improve productivity, reduce costs and rationalize personnel.

TABLE 3

Characteristics of the Automating of Data Entry by Organization

PROCESS OF AUTOMATING DATA ENTRY / ORGANIZATION	1	2	3	4	5	6
1. Decision to automate						
. Year	1983	1977	1984-85	1975	1983	1975
. Initiative	Senior Management	Senior Management	Senior Management	Senior Management	Senior Management	Senior Management
2. Planning						
. Implementation Strategy/Plan	No	Yes	Yes	Yes	Yes	No
. Setting Objectives	Yes	Yes	Yes	Yes	Yes	Yes
. Setting up a Committee	Yes (1978) later abolished	Yes	Yes(1983-84) abolished in 1985	Yes	Yes	No
. Preliminary Studies	No	Yes	Yes	Yes	No	No
. Choice of Technology:						
- Decision	Dictated by subcontractor	Senior management	Senior management	Senior management	Dictated by subcontractor	Senior management and compatibility with subcontractor
- Type of Technology	Computer terminals	Computer terminals	Computer terminals and micro-computers	Computer terminals and micro-computers	Dictated by subcontractor	Computer terminals
3. Implementation of Pilot Project:						
. Type	Trial simulations	Pilot project	Trial simulations	Trial simulations	Trial simulations	Trial simulations
4. General Implementation						
. Year	1986-....	1987-....	1986-....	1985-....	1986-....	1985-....
. Number of Departments Involved	11	All	3-4	3-4	10-12	3-4
. Completed	No	No	No	No	No	No
5. Assessment						
. Type	None	Informal	Informal	Informal	Formal	None
. Achievement of Objectives	Partial	Yes	Yes	Yes	Partial	Partial
. Satisfaction with Implementation:						
- Managers	Not very satisfied	Moderately satisfied	Satisfied	Satisfied	Not very satisfied	Not very satisfied
- Those Responsible for Automation	Moderately satisfied	-	Satisfied	Satisfied	Moderately satisfied	Moderately satisfied

TABLE 4

Characteristics of the Introduction of Word Processing by Organization

PROCESS OF INTRODUCING WORD PROCESSING / ORGANIZATION	1	2	3	4	5	6
1. Decision to Automate						
. Year	1986	1984	1982	1982	1982	1982
. Initiative	Office Automation Co-ordinator	Senior Management	Senior Management	Senior Management	Senior Management	Senior Management
2. Planning						
. Implementation Strategy/Plan	No	Yes	Yes	Yes	No	No
. Setting Objectives	Yes	Yes	Yes	Yes	Yes	Yes
. Setting up a Committee	No	No	Yes(1983-84) abolished in 1985	Yes	No	No
. Preliminary Studies	No	Yes	Yes	Yes	Yes	Yes
. Choice of Technology:						
- Decision	Office Automation Co-ordinator	Senior management	Senior management	Senior management	Senior management	Senior management
- Type of technology	. Computer terminals with word processing software	. Electronic typewriters . Dedicated word processors	. Dedicated word processors . Micro-computers with word processing software	. Dedicated word processors . Micro-computers with word processing software	. Dedicated word processors . Micro-computers with word processing software	. Dedicated word processors . Micro-computers with word processing software
3. Implementation of Pilot Project:						
. Type	none	Equipment tests	Two pilot projects	Two pilot projects	none	none
4. General Implementation						
. Year	1986-....	1985-1987	1984-1988	1983-....	1984-1988	1982-1988
. Number of Departments Involved	6	All	All	All	All	All
. Completed	No	Yes	Yes	No	Yes	Yes
5. Assessment						
. Type	none	none	none	formal	none	none
. Achievement of Objectives	Partial	Yes	Yes	Yes	Yes	Yes
. Satisfaction with Implementation:						
- Managers	Moderately satisfied	Satisfied	Satisfied	Satisfied	Satisfied	Moderately satisfied
- Those Responsible for Automation	Moderately satisfied	-	Satisfied	Satisfied	Satisfied	Satisfied

The two government agencies and one organization in the financial sector drew up structured and defined computerization or automation programs to enable themselves to plan and co-ordinate the entire implementation process. The two hospitals and one of the financial organizations did not formalize their strategy with formal planning, and did not conduct preliminary studies such as a needs analysis or analysis of the various types of computer equipment available. Their decisions depended to some extent on the constraints imposed by the subcontractors responsible for developing computer programs and/or computer processing, whether partial or total, of the organization's data.

The choice of computer-based tools was generally determined by senior management, acting on recommendations of those responsible for automation or outside consultants. For data entry, all the organizations bought computer terminals connected to the organization's mainframe computer in order to promote the standardization of equipment. The organizations had a variety of word processing equipment: electronic typewriters, dedicated word processors, computer terminals, and microcomputers with word processing software. In general, organizations favoured standardization of equipment.

For both types of technology, implementation can be broken down into two stages. During the first stage, the organizations try out the computer equipment in a fairly limited number of departments, and in the second phase, the technology is implemented more generally throughout different departments or the entire organization. Data entry trial simulations lasted only a few weeks so that the computer programs could be tested.

Although all the organizations had the automation of data entry in all departments as an objective, this objective has not yet been achieved. In all the organizations, however, word

processing equipment is available throughout the organization or will be very shortly.

With the exception of organization 5 for data entry and organization 4 for word processing, no formal assessment was conducted in the organizations studied. Managers were nonetheless relatively satisfied with the introduction of the computer technology, and in their opinion, the automation objectives were fairly well achieved overall. The lesser degree of satisfaction among some managers is due to technical problems, unforeseen delays, unavailability and lack of support of programmers, lack of an implementation strategy, lack of consultation, and insufficient human, financial or material resources.

1.1.2 Adaptation of Human Resources Management Policies As a Result of Implementation of Computer Technology

Comments received from managers and those in charge of human resources management show that, in general, organizational human resources management policies have not changed significantly following the implementation of computer technologies (see Table 5). The main explanation these managers offered is that they consider the computer equipment to be new tools that make users' work easier.

Nonetheless, some organizations (2 and 3) were more concerned with their human resources management policies and attempted to adapt them to the new job requirements of the computer technology. Aspects related to training and the physical work environment seem to have been subject to the greatest number of changes in all the organizations studied.

TABLE 5

Modifications of Human Resources Management Policies by Organization

HUMAN RESOURCES MANAGEMENT POLICIES \ ORGANIZATION	1	2	3	4	5	6
1. Job Descriptions	No change	Some jobs reassessed	Some jobs reassessed	No change	No change	No change
2. Recruiting	No change	No change	No change	No change	No change	No change
3. Monitoring	No change	No change	No change	No change	No change	No change
4. Work Hours	No change	No change	No change	No change	No change	No change
5. Wages	No change	Increase in some wages	Increase in some wages	No change	No change	No change
6. Occupational Health & Safety	No change	No change	Health & safety guide	No change	No change	No change
7. Physical Work Environment	No change	Improvements	Improvements	Some improvements	Some improvements	Some improvements
8. Office Furniture	ergonomic (some departments)	ergonomic (all departments)	ergonomic (all departments)	ergonomic (all departments)	ergonomic (all departments)	ergonomic (some departments)
9. Training	Yes	Yes	Yes	Yes	No	No

Automation of data entry and the introduction of word processing had no impact on the job descriptions and wages of workers in these two job categories, with the exception of a few positions at organizations 2 and 3. Following a re-evaluation of their jobs, clerk-typists at organization 2 and some clerks at organization 3 who specialized in data entry had their jobs reclassified, the first as automated machine operators, and the second as specialized technicians. In both cases, the reclassification resulted in an increase in the employees' wages.

None of the organizations reviewed its hiring criteria to take into account the new qualifications required by computer

technology. Most managers interviewed considered word processing skills to be an asset in getting a job, but not a compulsory criterion in filling it. In some cases, word processing skills could be the deciding factor when two secretaries met the requirements of a job; the one with word processing skills would be preferred.

With the introduction of computer technology, no major change was made to organizational monitoring policies. Electronic monitoring of data entry operators remains a common practice in some organizations (2, 4 and 6), while productivity reports are used in others (organizations 2 and 6) to record the quantity and quality of word processor operators' output.

The work hours currently in force in the organizations are the same as those that existed before the introduction of computer technology. The organizations are not too concerned with the occupational health and safety of users of computer technology, with the exception of organization 3, which has developed a guide on using cathode ray tubes (CRTs--computer screens). Few of the organizations in our study consider that breaks have become necessary with the introduction of computer technology, and the practice of providing them is not very widespread. Only data entry operators at organizations 2 and 4 and word processor operators at organization 2 are given special breaks because they use CRTs. Generally speaking, users have the standard breaks provided for in the collective agreement.

In most organizations, the introduction of computer technology was a factor in improving, not deteriorating, the physical work environment. Policies concerning the purchase of ergonomic office furniture suited to the equipment were developed at organizations 2, 3, 4 and 5. Nonetheless, some data entry departments at organizations 2 and 4 have office furniture which several years ago was considered to be ergonomic, but now does not

meet new ergonomic standards and is not suited to the new equipment. At organizations 1 and 6, some administrative units purchased ergonomic furniture. Some organizations (2 and 3) were avant garde in their approach to office furniture; they did studies to determine the type of furniture best suited to integrated, multipurpose, automated workstations.

Modifications were made to the users' physical environment (lighting, ventilation, humidity, etc.) in some organizations. Nonetheless, these changes depended chiefly on personal initiatives of users and managers.

Structured training courses, given in-house or outside, are currently offered to data entry operators and word processor operators in most of the organizations studied. Organizations 2, 3 and 4 have their own training centres. Organization 1 calls upon the services of an outside training firm to teach users introductory word processing, while in-house people in charge of office automation provide training in data entry. Generally speaking, employees are taught about data entry by the heads of centralized units, except at organizations 5 and 6, where they are trained on the job with the help of their immediate superior. Word processor operators in both those organizations receive a few days of training offered by the equipment manufacturers.

Generally speaking, data entry operators are trained for only a few hours, while word processor operators are trained for two to five days, depending on whether they receive additional advanced training as well as basic training.

1.1.3 Personal Characteristics of Respondents

Employees who do data entry hold positions as operators; technicians; and office, admissions and archive clerks; and employees who do word processing work as operators, secretaries and

clerk-typists. In this report, the term operator is used to refer to employees holding any of these positions.

Data entry operators in all six organizations studied have personal characteristics similar to those of word processor operators (see Table 6).

On average these employees are between 30 and 44 years old and have a secondary or college level education. They have one to three years of experience on their current job and using computer technology. Respondents spend an average of 15 to 24 hours per week using computers.

TABLE 6

Personal Characteristics by Technologys
(Data Entry and Word Processor Operators)

All Six Organizations

TECHNOLOGY / PERSONAL CHARACTERISTICS (AVERAGE)	WORD PROCESSING	DATA ENTRY	WORD PROCESSING AND DATA ENTRY
1. Age	30-44 years	30-44 years	30-44 years
2. Level of Education	Secondary and college	Secondary and college	Secondary and college
3. Experience on Current Job	1-3 years	1-3 years	1-3 years
4. Experience Using Computer Technology	1-3 years	1-3 years	1-3 years
5. Number of Hours per Week Using Computer	15-22.5 hours	15-22.5 hours	15-22.5 hours

The employees' personal characteristics vary from organization to organization, and depending on the type of computer technology

used (see Tables 7 and 8). The following points are particularly noteworthy:

- Workers at organization 1 are relatively better educated and word processing operators there, despite a great deal of experience on their job, do not use the word processors much.

- Data entry operators with the most experience work at organization 2. Moreover, respondents there spend most of their time either doing data entry or word processing.

- At organization 3, the employees we studied had relatively little experience on their current job.

- Data entry operators at organization 4 spend more hours on average doing data entry at computer terminals. Respondents there had data entry as their sole task.

- At organization 5, data entry operators spent a small amount of their time doing data entry, while word processor operators used their word processors for a large part of their work week.

- The lowest average age and highest level of education of all respondents in the same organization was at organization 6.

According to our observations at all organizations, work is organized differently depending on the technology. Except at organization 2, most word processor operators worked at individual workstations, not in pools. They were independent, subject to little monitoring of their work, and their tasks were of average variety and complexity. On the other hand, data entry operators are largely grouped into pools of varying sizes. They have a very limited degree of independence, are subject to fairly close monitoring, and do a limited variety of not very complex tasks.

TABLE 7

Personal Characteristics of Data Entry Operators by Organization

PERSONAL CHARACTERISTICS (AVERAGE) \ ORGANIZATION	1	2	3	4	5	6
1. Age	30-44 years	30-44 years	30-44 years	30-44 years	30-44 years	15-29 years
2. Level of Education	College	College	Secondary	Secondary	Secondary and college	Secondary and college
3. Experience on Current Job	1-3 years	3 years or more	1-3 years	3 years or more	3 years or more	1-3 years
4. Experience Using Computer Technology	1-3 years	3 years or more	6 months-1 year	3 years or more	1-3 years	1-3 years
5. Number of Hours per Week Using Computer	15-22.5 hours	15-22.5 hours	15-22.5 hours	30-37 hours	7.5-15 hours	22.5-30 hours

TABLE 8

Personal Characteristics of Word Processor Operators by Organization

PERSONAL CHARACTERISTICS (AVERAGE) \ ORGANIZATION	1	2	3	4	5	6
1. Age	30-44 years	15-29 years	15-29 years	30-44 years	30-44 years	15-29 years
2. Level of Education	college	Secondary	Secondary	Secondary	College	College
3. Experience on Current Job	3 years or more	1-3 years	1-3 years	1-3 years	3 years or more	1-3 years
4. Experience Using Computer Technology	6 months-1 year	1-3 years	1-3 years	1-3 years	1-3 years	1-3 years
5. Number of Hours per Week Using Computer	7.5-15 hours	30-37.5 hours	15-22.5 hours	15-22.5 hours	22.5-30 hours	15-22.5 hours

1.2 INSTRUMENTS USED IN STUDY

Three instruments were used to gather data:

(1) A structured standard questionnaire administered to users of computer technology.

(2) An observation chart filled out in the workplace of users of information technology.

(3) A semistructured interview with people in charge of computerization or office automation, heads of human resources management and immediate superiors of users of computer technology.

There are a number of advantages in using three instruments. First, they make it possible to determine the perceptions of different types of employees, to compare them and to see whether there are any similarities among them. Second, the complementary nature of the instruments used not only enhances the quality of the information gathered, but also lends itself to the analysis and interpretation of findings. For example, data from the observation chart and interview may help us to understand some answers to the questionnaire.

CHAPTER 2

EFFECTS ON USERS

Only the effects identified most frequently by researchers have been considered in this report. We have attempted to verify whether the data entry and word processing computer technology affects the number of operators, variety and complexity of tasks, autonomy, job mobility, monitoring and supervision, occupational health, social interactions, physical environment, and workers' attitudes toward and satisfaction with computer technology.

The impact of the computer technology varies according to the nature of the computer-based tools, rather than the characteristics of the organization itself. We have therefore chosen to analyze the effects of automated data entry and word processing technology separately, and to compare the organizations in terms of the specific impact of each type of technology.

2.1 AUTOMATED DATA ENTRY

The automation of data entry has both positive and negative effects (see Table 9). On the one hand, it is a factor in the elimination of jobs, closer supervision, deterioration of social interactions and increased health problems. On the other hand, the implementation of automated data entry technology encourages both a great variety and complexity of tasks, an improvement in the physical work environment and an improvement in positive attitudes toward computer technology. Employees' independence and opportunities for job mobility remain unchanged. Their degree of satisfaction varies from organization to organization; no general trend can be determined.

TABLE 9

Effects of Data Entry Technology on Human Resources by Organization

Effects	Organization						
	1	2	3	4	5	6	
Number of Jobs	Slight decrease	Decrease	No change	Decrease	No change	Slight decrease	Decrease
Variety of Tasks	No change	Decrease	Increase	Increase	No change	Increase	Slight increase
Complexity of Tasks	Decrease	No change	Increase	No change	Increase	Decrease	Increase
Autonomy	No change	No change	Increase	No change	No change	Increase	No change
Job Mobility	No change	No change	No change	No change	No change	No change	No change
Monitoring and Supervision	Increase	No change	Decrease	No change	No change	Decrease	Increase
Health Problems	Increase	Increase	Increase	Increase	Decrease	Increase	Slight increase
Physical Environment	Improvement	Improvement	Improvement	Deterioration	Slight improvement	Slight improvement	Slight improvement
Social Interactions	Decrease	No change	Frequent & slight decrease	No change	Slight & No change	Slight Decrease	Slight Decrease
Attitude	Improvement	Improvement	Improvement	Neutral & improvement	Positive & improvement	Positive & improvement	Improvement
Satisfaction	Increase	Decrease	No change	Low & decrease	High & increase	Increase	Slight increase

2.1.1 Number of Jobs

According to the information gathered from managers, in general the number of jobs in organizations declined only slightly after the automation of data entry technology. In their view, however, jobs involving nothing but data entry may disappear. At

organization 3, the number of jobs did not decrease, given its policy of encouraging operators to do a variety of tasks rather than assigning them exclusively to data entry. The reduction in jobs has not yet started at organization 5 because automation has not made great inroads there, but managers anticipate a major drop in the number of data entry jobs in future as various departments become increasingly automated.

According to the results of the users' questionnaire, data entry operators do not seem to be aware that data entry operators' jobs in their organizations may eventually be eliminated as a result of automation. Their optimistic outlook may be explained by the fact that in unionized organizations, their job security is guaranteed by the collective agreement.

2.1.2 Variety of Tasks

On the whole, data entry operators perceive that their tasks have become slightly more varied since the introduction of computer technology. We can see that, because of a greater standardization in the requests to be processed, workers at organization 2 perceive that the variety of their tasks has decreased with automation.

We have noted very little change in users' degree of satisfaction with the variety of their tasks. The majority of data entry operators stated that they are satisfied with the variety of their tasks.

2.1.3 Complexity of Tasks

Automation has not significantly altered the degree of complexity of tasks in any of the organizations. In the majority of organizations, users perceive that the complexity of their tasks has increased slightly or remained the same since the introduction of automation. We note, however, a slight decrease at

organizations 1 and 6, largely due to the automation of client files, which makes the job of data entry operators easier by giving them direct access to information and reducing the amount of handling necessary.

Most respondents are satisfied with the complexity of their tasks, except those at organizations 1 and 4, where the proportion of satisfied users is not as high. Organization 4 stands out from the others in terms of the high number of data entry operators who are dissatisfied with the complexity of their work. The high degree of dissatisfaction may be explained by the low degree of complexity of their tasks and the low degree of diversity of their work, which is routine and boring. The relatively lower degree of satisfaction of data entry operators at organization 1 with the complexity of their work may be attributed to a lack of training, which limits the complexity of the tasks they can do, and to the incomplete development of existing computer programs, which do not fully meet the requirements of the tasks they must carry out.

2.1.4 Autonomy

A slight minority of data entry operators perceive that they have an increased amount of autonomy at work, except at organizations 3 and 6, in the financial sector, where the majority of respondents stated that automation made them more independent. The perception of increased autonomy by financial sector employees can be explained by the way work is organized and the style of management. According to what managers there told us, they have aimed to achieve greater flexibility in the way work is organized. They preferred not to assign data entry operators to data entry tasks exclusively, in order to leave room for their initiative and creativity in doing diversified tasks.

Data gathered by means of the questionnaire do not enable us to conclude whether the autonomy of data entry operators has

decreased or remained constant at organization 4. Nonetheless, our observations and interviews conducted on the spot lead us to suppose that the degree of independence has remained the same, since no major change has occurred in work procedures or the way work is organized. Data entry operators at this organization are grouped in a pool and there is very little room for personal initiative in doing their work.

A large majority of respondents are satisfied with the degree of autonomy they have in doing their data entry work, except at organization 4, where work standards are very strict, and at organization 2, where employees' opinions are divided according to whether their jobs are regular or temporary.

There is a relationship of some kind between data entry operators' satisfaction with their independence at work and their perception of the increase in the degree of independence as a result of the introduction of automation. Employees who do a variety of tasks and have some flexibility in organizing their work are more satisfied with their degree of autonomy. Workers assigned solely to data entry and subject to very strict work standards are the least satisfied with their autonomy.

2.1.5 Job Mobility

Data entry operators in all organizations do not perceive the introduction of automation as a factor in improving their job mobility. The majority responded that their job mobility has not increased following technological changes.

These findings are in keeping with the comments of managers, who stated that chances of advancement within the organization remained the same after the introduction of computer technology. The lack of recognition of new skills and new knowledge by human

resources management policies may be the reason that the job mobility of users has remained unchanged.

Data gathered at organization 6 do not enable us to determine the reasons for the relatively steep increase in job mobility as perceived by data entry operators there. Nonetheless, we have determined that it is the workers with several tasks other than those related strictly to data entry who perceive possible improvements in their mobility within the organization, given the greater flexibility of their jobs.

Respondents do not perceive that implementation of automation was accompanied by an increase in their job mobility, but they consider that this technological change may potentially facilitate their mobility within the organization (intrafirm mobility) and their mobility outside the organization (interfirm mobility). Generally speaking, they consider technological change to be a factor favourable to interfirm mobility.

2.1.6 Monitoring and Supervision

In all organizations, the perception of the majority of respondents has changed little with regard to the amount of monitoring of their work since the introduction of automation. In general, a slight increase in the average index can be seen, except at the organizations in the financial sector (3 and 6), where the amount of monitoring decreased. These findings confirm what managers told us. They pointed out that the introduction of computer technology did not reinforce the organization's monitoring policies, which are an extension of tendencies that existed before automation. Organizations maintained the status quo with respect to monitoring policies, because computer technology provides new work tools, and is not an aid to human resources management. In organizations in the financial sector (3 and 6), managers have counted on greater flexibility in monitoring the work of data entry

operators because their management policy is to allow a certain degree of independence in doing tasks.

Data entry operators perceive the monitoring of their work to be much less strict than it actually is. Data entry operators perceive that the amount of monitoring has increased slightly since the introduction of computer technology, however. Respondents may have such a weak perception of the strict control exercised over their work because monitoring is done only for administrative purposes and not for appraisal of individual performance. Moreover, data entry operators were already monitored fairly closely before the implementation of computer technology, so they perceive the close monitoring since then to be less strict than it really is. In fact, we note that in organizations in the financial sector (3 and 6), where monitoring is perceived to be relatively close, data entry operators perceive monitoring to have decreased since the introduction of computer technology.

In all organizations except organization 4, respondents are for the most part satisfied with the amount of monitoring of their work, and their degree of satisfaction has remained unchanged since the implementation of technological change. The low number of satisfied data entry operators at organization 4 may be explained by the very strict monitoring to which they are subject, because of the very highly specialized nature of their tasks.

2.1.7 Health Problems

Overall, data entry operators perceive their health problems to be moderately frequent since automation and more frequent than when automation was introduced.

Respondents at organizations 2, 4 and 6 feel that they experience health problems more slightly frequently since their work has been automated. The perceptions of users at

organizations 2 and 6 may be related to the way their work is organized: they are grouped in a pool and they spend a great deal of time using their computers to do extremely standardized tasks. The same explanations apply to data entry operators in organization 4, who consider their office to be ill-suited to the requirements of the technology; some of them must also use a CRT and microfiche display screen at the same time.

When we analyze the health problems one at a time, we notice that in general, at each organization except organization 5, the perceptions of the majority of data entry operators have not changed since the introduction of automation. Nonetheless, since automation, the average frequency of signs of eyestrain, backache and headache have increased slightly throughout all the organizations, except organization 5. The frequency of eyestrain has increased the most. Less stress is felt since the implementation of technological change, except at organizations in the financial sector (3 and 6). Stress seems to diminish as workers become accustomed to their new tools and how to use them. The increase in stress perceived by data entry operators at organization 6 may be explained by the many changeovers in computer systems and the lack of experience of several respondents in using computer terminals. The decrease in health problems perceived by data entry operators at organization 5 may be attributed to its policies for managing the introduction of computer technology, which encouraged worker involvement.

In five organizations, the majority of respondents are dissatisfied with the human resources management policies for reducing health problems. Unlike the other respondents, employees at organization 2 are satisfied, since their immediate superiors are very concerned with everything to do with the users' health. The higher rates of dissatisfaction among employees at organizations 4 and 6 may be related to the greater number and intensity of each of the health problems they perceive.

2.1.8 Physical Environment

The opinions of data entry operators are very divided concerning the quality of their physical work environment. Organizations 5 and 6 were the only ones where most workers are pleased with their furniture and office. These two organizations bought new furniture specially designed for data entry computer equipment. The efforts to arrange the data entry centre at organization 6 are also noteworthy.

In general, we found that organizations made very few changes to the office and furniture of data entry operators after automation; respondents mentioned how little their physical environment had changed since CRTs were introduced. The high percentage of workers at organization 4 who perceived there to be a deterioration in the quality of their furniture and office after their tasks were automated may be explained by the pool arrangement: the furniture is 10 years old, the office has undergone very little modification, the lighting is inappropriate and the noise level is high.

2.1.9 Social Interactions

The social interactions of data entry operators with their co-workers and immediate superior are perceived as being relatively frequent. After the implementation of computer technology, there was a slight drop in the frequency of social interactions, perhaps because of the stricter work constraints.

At organization 3, social interactions are relatively more frequent. The type of work organization preferred there, a small pool, seems to encourage discussion and co-operation between workers more than individual workstations do. The employees also

enjoy better working conditions, which encourage teamwork and co-operation among groups.

On the other hand, the lower frequency of social interactions perceived at organization 4 may be attributed to the larger size of the pools, the greater amount of time spent typing and the stricter standards to which work organization and scheduling are subject.

2.1.10 Attitude Toward Computer Technology

Data entry operators in all organizations showed a positive attitude toward computer technology. Since the introduction of computer-based tools, their attitude toward computer technology has become more positive, especially at organization 3, where a majority of respondents have become more positive. The improvement in the attitude of data entry operators can be explained by the fact that they see the new technology as progress in accomplishing their tasks, which earlier were done manually or outside the organization. The greater degree of positiveness among respondents at organization 5 may be attributable to the fact that automation was introduced recently, and to a management style that encourages a diversity of tasks, a great degree of independence and little monitoring. The fairly neutral attitude of data entry operators at organization 4 can be explained by a certain amount of indifference toward the technology, which has become a familiar tool, since automation occurred several years ago and tasks and working conditions have changed little since then.

2.1.11 Satisfaction with Computer Technology

Overall, the majority of data entry operators, except those at organization 4, are satisfied with the computer technology they use and their working conditions.

The dissatisfaction of workers at organization 4 may be attributable to the highly specialized nature of their work, the low degree of variety and complexity of their tasks, limited amount of independence and job mobility, the few modifications made to their physical environment, the closer monitoring of their work, the declassification of their jobs, and the drop in the number of data entry jobs. These reasons may also explain the relatively low degree of satisfaction of data entry operators at organization 2, where the seasonal nature of the work and furniture not designed for the new computer terminals are factors in reducing satisfaction.

The very high degree of satisfaction among data entry operators at organization 5 may be explained by the greater diversity of their tasks, the fairly relaxed monitoring of their work and the purchase of new ergonomic furniture.

The respondents' degree of satisfaction with computer technology has not changed since the advent of automation, except at organization 4, where a significant drop in the average level of satisfaction can be seen, due notably to the declassification of some jobs and the reduction in the number of data entry jobs.

2.2 WORD PROCESSING

The introduction of word processing technology entails more positive than negative effects on employees' working conditions (see Table 10). After the introduction of word processing equipment, we can see an increase in monitoring of tasks and health problems perceived. Nonetheless, several positive effects accompany this technology: increase in the variety and complexity of tasks, autonomy, social interactions, positive attitudes toward computer technology, degree of satisfaction and improvement of the physical environment of workstations. The number of jobs and the possibility of job mobility have not changed as a result of technological changes involving word processing.

TABLE 10

Effects of Word Processing Technology on Human Resources by Organization

Effects	Organization						
	1	2	3	4	5	6	
Number of Jobs	No change	Slight decrease	No change	No change	No change	No change	No change
Variety of Tasks	Decrease	Increase	Increase	Increase	Increase	Increase	Increase
Complexity of Tasks	Slight increase	Increase	Slight increase	Increase	Slight increase	Increase	Increase
Autonomy	No change	Increase	Increase	No change	Increase	Increase	Increase
Job Mobility	No change	No change	Increase	No change	No change	No change	No change
Monitoring and Supervision	Decrease	High & decrease	Increase	Increase	No change	No change	Slight increase
Health Problems	Increase	Many & increase	Slight increase	Decrease	Decrease	Many & increase	Slight increase
Physical Environment	Slight improvement	Improvement	Improvement	Slight improvement	Improvement	Improvement	Improvement
Social Interactions	Decrease	Slight increase	Slight increase	Slight increase	Increase	Increase	Slight increase
Attitude	Improvement	Improvement	Improvement	Improvement	Improvement	No change	Improvement
Satisfaction	Increase	Slight decrease	Slight decrease	Increase	Increase	Low & No change	Slight Increase

2.2.1 Number of Jobs

According to the managers interviewed, the number of word processor operators has remained constant despite the greater volume of work. There has been no reduction in the number of jobs; the number of employees has remained stable while the volume of work has increased. Where there has been a decrease or increase

in the number of jobs, it is attributable to organizational restructuring, not technological change.

Word processor operators are also of the opinion that the use of word processors does not result in a loss of jobs. The lack of opinions among respondents at organization 1 may be due to the fact that word processing equipment is not found throughout the organization because of the limited capacity of the mainframe computer. The opinions shared by word processor operators at organization 2 can be explained by the large number of temporary jobs involving the use of electronic typewriters.

2.2.2 Variety of Tasks

Overall, and for each organization, word processor operators do a variety of tasks, much more diverse than those assigned to data entry operators. Word processor operators perceive the variety of their tasks to have increased with the introduction of this technology, except at organization 1, where a decrease can be noted. The fact that these word processor operators perceive a decrease in the variety of their tasks can be explained by first, the limited use they make of their equipment (a few hours per week) and second, their limited access to the central printer (for some types of work), which causes delays in the delivery of documents.

Most workers perceive that the diversity of work to be done has increased, except at organization 1, for the reasons noted above.

The majority of word processor operators are satisfied with the variety of their tasks; their satisfaction is greater than that of data entry operators. Overall, we find a slight increase in the degree of satisfaction since the introduction of word processing.

2.2.3 Complexity of Tasks

Word processor operators perceive their tasks to be moderately complex. Respondents at organizations 2 and 6 describe their tasks as being more complex than respondents at other organizations; the nature of their work may explain this finding. At organizations 1 and 5, in the hospital sector, the restricted use of word processing equipment for simple work (letters, short reports) and the limited capabilities of the type of equipment they have does not make it easy for word processor operators to do complex tasks. The purchase of new nondedicated word processing equipment that makes their job easier may explain why respondents at organization 3 perceive their tasks to be moderately complex.

Except for those in the hospital sector, for the reasons already given, the majority of respondents are of the opinion that the introduction of word processing equipment has increased the complexity of their work.

In each organization, the majority of word processor operators are satisfied with the complexity of their tasks. A slight increase can be seen in the degree of satisfaction since the introduction of word processing. Generally speaking, there does not seem to be any relationship between respondents' degree of satisfaction with the complexity of their work and the average degree of complexity of their tasks. The smallest proportion of word processor operators who are satisfied with the complexity of their job was found at organization 4. According to our on-the-spot observations, their lesser degree of satisfaction may be explained by volume of work, rather than its nature.

2.2.4 Autonomy

The majority of word processor operators feel that their autonomy in doing their work has increased since the implementation

of the new technology, with the exception of those at organizations 1 and 4, where a slight majority do not perceive that their independence has increased.

According to our on-the-spot observations, word processor operators in general are allowed more independence in doing their work than are data entry operators. The work standards and methods of word processor operators are not as strict as those that apply to data entry operators.

As was the case with data entry, organizations where employees perceive the increase in their degree of autonomy to be greatest are those which, according to our interviews with managers, encourage more flexibility in the organization of word processing tasks.

Word processor operators report a relatively high degree of satisfaction with their autonomy.

For all organizations, the degree of satisfaction is higher than that of data entry operators. Word processor operators are more satisfied with their independence because, generally speaking, they decide for themselves how to organize their work and what methods to use.

2.2.5 Job Mobility

In general, the majority of respondents do not perceive their job mobility to have increased as a result of the introduction of word processing, except at organization 3. Nonetheless, word processor operators perceive their job mobility to have increased more than do data entry operators, notably because of the greater variety of positions that they could fill and the greater stability of their jobs.

Word processor operators at organization 3 are more optimistic than those in other organizations since they have greater possibilities of advancement. Because of internal promotion and training policies, they are trained in how to use new computer technology, which may enable them to fill other positions in the organization.

The majority of word processor operators consider that learning to use word processing equipment is a potential factor in making it easier for them to move within the organization or outside it, and this proportion is higher than that of data entry operators. According to our interviews with managers, word processor operators have greater chances for advancement within the organization and outside it than do data entry operators, whose jobs are decreasing in number, and who, in the organizations studied, rapidly reached the top grade in their job category (within six months to a year). On the other hand, word processor operators may go up several levels within their job category (clerk-typist, word processor operator, executive secretary, etc.), and they have more opportunities outside the organization, given the strong demand on the job market for word processing specialists. The fact that respondents in the hospital sector (organizations 1 and 5) perceive their intrafirm mobility to be more limited can be explained, as for the data entry operators, by the criteria for promotion, which favour seniority rather than skill.

Word processor operators' degree of satisfaction with job mobility, although greater than that of data entry operators, is relatively low. In half of the organizations, a slight majority are satisfied, and in the others, the percentage of satisfied employees varies between 18% and 48%. More respondents at organizations 2, 4 and 6 have the job title of word processor operators, and they consider their possibilities of advancement to be relatively lower than those of secretaries.

2.2.6 Monitoring and Supervision

The work of word processor operators is generally monitored less than that of data entry operators. Only the word processor operators at organization 2 feel that their work is extremely closely monitored. These findings match our observations in the workplace. Generally speaking, word processor operators have individual workstations throughout the various administrative units or are grouped into small pools. Their work has to do with their department, and is less standardized than that assigned to data entry operators. They are monitored by their immediate superior or department head, who chiefly assesses the quality and appearance of the work. In organization 2, the quantity and quality of work are recorded; this makes it possible to do an overall evaluation of efficiency and effectiveness of the word processing centre, which is used to remind them of daily productivity standards when they do not meet them.

We note that word processor operators perceive there to be a greater increase in monitoring than do data entry operators since the introduction of technology. With typewriters there was practically no monitoring, so word processor operators are not very accustomed to being supervised closely and are more aware of this new work standard. The relatively large drop in the degree of monitoring perceived by word processor operators at organization 5 may be attributed to the recent organizational restructuring, which enabled some secretaries who used to work in pools to move to individual workstations when new departments were created.

Monitoring has remained moderately strict since word processing equipment was introduced. According to our on-the-spot observations, only the quality and form of the work of word processor operators are monitored.

The opinion of word processor operators is extremely divided concerning their satisfaction with the monitoring of their work. Only organization 5 has a large majority of satisfied employees, following the organizational restructuring mentioned earlier. At organizations 1 and 4 there is a large proportion of respondents who have no opinion concerning their satisfaction with the monitoring of their work. This neutrality may be explained, at organization 4, by the work atmosphere and administrative restructuring, and at organization 1 by the limited number of tasks done using word processing equipment.

2.2.7 Health Problems

Word processor operators perceive relatively few problems of stress, eyestrain, headache and backache. In general, they mention only one or two health problems. A higher proportion of the workers at organizations 2 and 6 report a greater number of health problems. Nonetheless, at organization 6, the frequency of problems has decreased slightly since the introduction of word processing equipment.

The frequency of every health problem--except stress, at organizations 3, 4 and 5--is higher since the introduction of word processing equipment.

Eyestrain is the health problem most frequently experienced by word processor operators, followed in decreasing order by headache, stress and backache. According to our observations in the workplace, the greater frequency of eyestrain is related to improper lighting and to the intensive use of CRTs without breaks or with breaks that are too short.

As is the case for data entry, the decrease in stress after automation at organizations 3, 4 and 5 may be explained by a greater mastery of the technology.

A slight majority of word processor operators are dissatisfied with human resources management policies intended to reduce health problems, except at organization 3, where they are satisfied. The higher rate of dissatisfaction among employees at organizations 4 and 5 is at odds to the below-average frequency of problems reported by respondents.

2.2.8 Physical Environment

The organizations usually purchased ergonomic furniture specially suited to word processing equipment. The majority of word processor operators feel that their office furniture and arrangement is completely appropriate. At organizations 2 and 5, where we saw a particularly careful arrangement of the office and specially adapted lighting, we note a very high percentage of respondents who felt that their office and furniture were satisfactory. On the other hand, the work areas were very small and the physical environment was very little changed at organization 1; word processor operators were aware of that, as their responses to the questionnaire show.

Word processor operators feel that their furniture is more appropriate than their office arrangement. They feel that these two aspects of the physical environment are better suited to computer technology than do data entry operators.

In general, respondents perceive their furniture and office to have changed very little since the introduction of word processing.

Nonetheless, the introduction of word processing equipment was a factor in improving the physical work environment (furniture and office), and the majority of word processor operators are satisfied. As with the data entry operators, the highest degree

of satisfaction with furniture and office arrangement was found at organizations 2 and 5, where the furniture and office were felt to be the most appropriate, while respondents dissatisfied with their office (organizations 3 and 4) consider them to be ill-suited to computer technology.

2.2.9 Social Interaction

Word processor operators have an average rate of social interactions with co-workers and a relatively high rate of social interactions with their immediate superior. The frequency of conversations is slightly above that of data entry operators. The greater degree of autonomy of word processor operators makes it easier for them to share their skills with their co-workers, unlike data entry operators, whose tasks are subject to much more severe constraints.

The index of social interactions of word processor operators is particularly high at organization 2, where there are a greater number of pools. The lower frequency of social interactions at organizations 1 and 4 may be attributable to the decentralized nature of their organizational structure. The word processor operators are spread out among administrative units that are far apart at organization 1, and even geographically distant at organization 4. This decentralization does not seem to provide a favourable context for communication among employees.

In all the organizations, the majority of respondents perceived very little change in their social interactions since the introduction of word processing. An exception was organization 1, where they perceived their social interactions to be less frequent since the introduction of word processing, because of their isolation in decentralized administrative units that do not promote interactions between co-workers.

2.1.10 Attitude Toward Computer Technology

Word processor operators have a slightly more positive attitude toward computer technology than do data entry operators. This greater acceptance of computer technology by word processor operators may be due to the more recent introduction of new tools, which are perceived to be innovative improvements that make their jobs easier.

The attitude of respondents toward computer technology has changed little since the implementation of word processing, and the majority of workers have maintained the same attitudes.

According to our observations at organization 4, the slightly less positive attitude of word processor operators there may be due to the increase in the volume of work after the introduction of word processing and to an unsatisfactory work atmosphere in several of the administrative units. We saw earlier that among word processor operators, the respondents at organization 4 were the most dissatisfied with the complexity of their tasks, their degree of independence, their job mobility, and the monitoring and supervision of their work.

Word processor operators at organization 5 are the respondents with the most positive attitude toward computer technology. Their high degree of satisfaction with their furniture and office, which a large majority consider to be completely appropriate, may influence their positive attitude toward word processing equipment.

2.2.11 Satisfaction with Computer Technology and Working Conditions

Word processor operators are slightly more satisfied with computer technology and their working conditions than are data

entry operators. Their degree of satisfaction has remained fairly stable since the introduction of computer technology.

Word processor operators at organization 5, like data entry operators there, are the most satisfied with their computer equipment, followed by respondents at organization 1. Word processor operators at organization 6 are the least satisfied.

The higher degree of satisfaction among word processor operators at organization 5 may be explained by the better characteristics of their work: diversity of tasks, not very close monitoring and ergonomic furniture. The employees at organization 6 have a low level of satisfaction, which may be due to the various changes they have been through since their work was automated, their problems with the subcontractor that developed programs, and their lack of training. The drop in satisfaction among respondents at organization 3 since the introduction of word processing may be related to the fact that several of them use the old word processors rather than the new ones.

The effects of computer technology vary from one organization to the other. For both types of technology under study, organization 5 maximizes the positive or neutral effects and avoids the negative effects. On the other hand, the maximum number of negative effects and minimum number of positive or neutral effects can be seen at organization 1. Both extremes can be seen in the same sector: hospitals. The economic sector therefore does not seem to be related to the kind of impact of data entry and word processing computer technology on human resources.

If an increase in the degree of satisfaction is an indicator of the success of the implementation of computer technology, then organizations 1, 5 and 6 have been successful in automating data entry, and organizations 1, 4 and 5 have been successful in introducing word processing.

It may seem paradoxical that at organization 1, the degree of satisfaction of respondents increased, although the highest number of negative effects can be found there. This situation can be explained by the limited number of significant statistical relationships between the impact of the computer technology and the satisfaction index. The level of satisfaction is more closely related to management variables, personal characteristics and job characteristics.

CHAPTER 3

VARIABLES EXPLAINING THESE EFFECTS

For each of the two types of technology studied (see Tables 11 and 12), there are several significant statistical relationships between job characteristics and the effects of computer technology on employees' working conditions. The personal characteristics of the respondents are also fairly closely related to the technological effects identified. The variables to do with management of the implementation of technological changes have fewer significant statistical links with the characteristics of the tasks and the frequency of social interactions of respondents. These variables are nonetheless related to the changes in attitudes toward computer technology, perceived increases in health problems, and satisfaction with the implementation of technological change. The statistical relationship between the increase in health problems and levels of positive attitudes on the one hand and satisfaction with computer technology on the other should also be pointed out.

3.1 DATA ENTRY

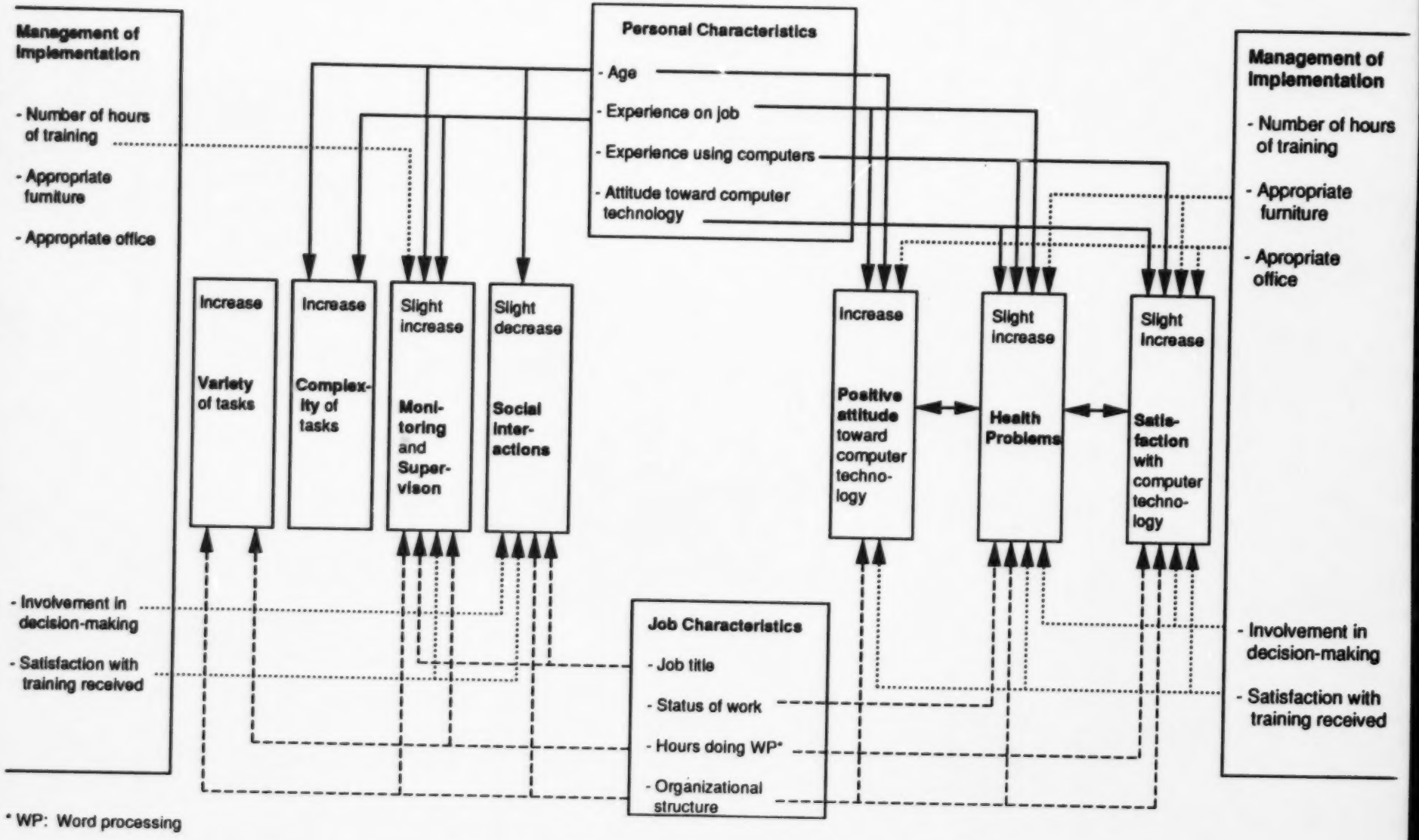
The variety and complexity of tasks are more closely related to job requirements than to personal characteristics or policies for managing computer technology. For all data entry operators, those whose tasks are more varied and complex had more hours of training, spend fewer hours doing data entry, work in pools, and have a job title of data entry clerk.

As is the case with the variety and complexity of tasks, the amount of monitoring and supervision, and the frequency of social interactions, the significant statistical relationships point up the influence of job characteristics in explaining these effects. Data entry operators who perceive their work to be closely monitored and those who perceive their social interactions to be

Table 11

Chart of Statistical Relationships in the Case of Word Processing

(number of observations = 187)

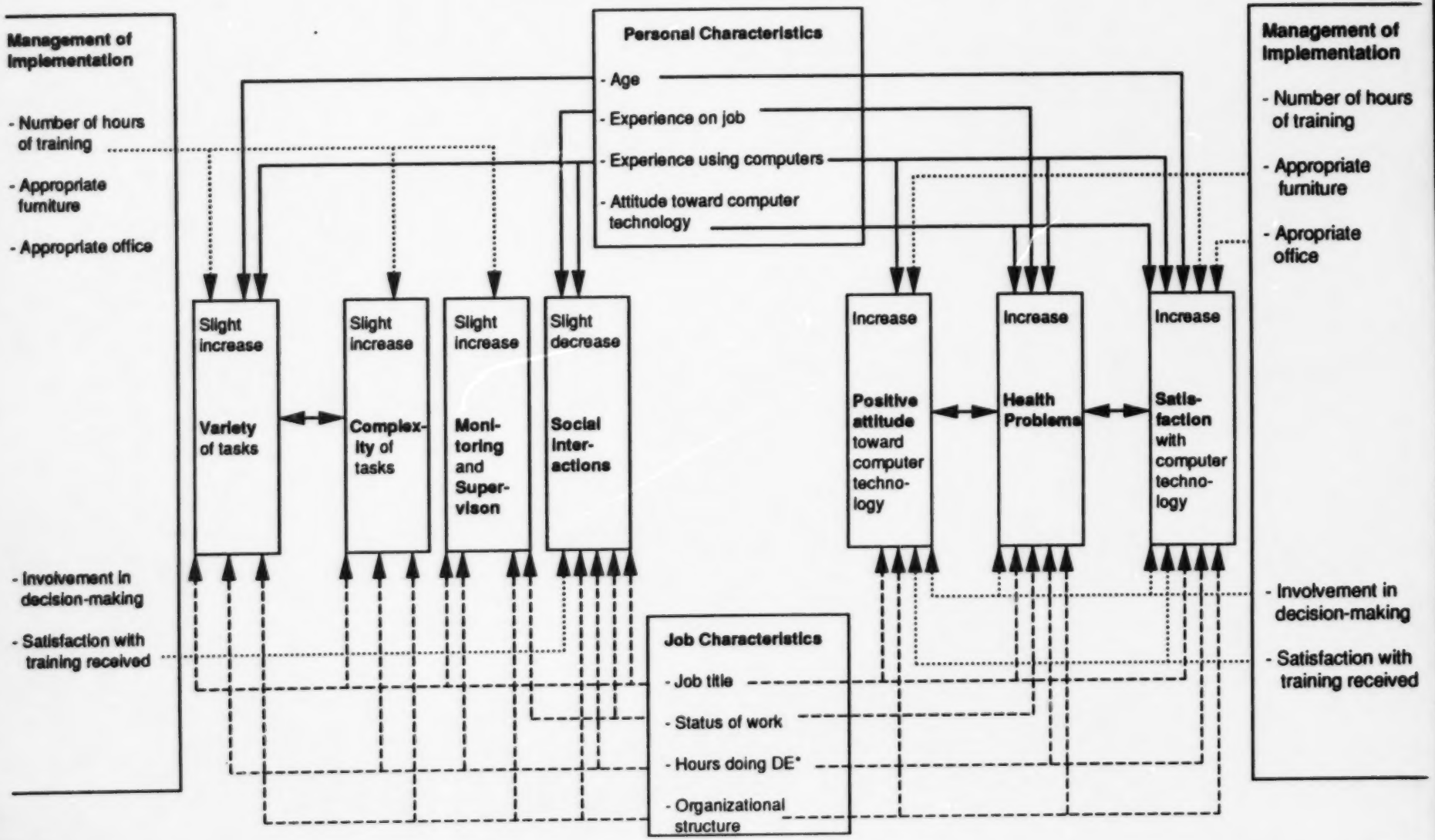


* WP: Word processing

Table 12

Chart of Statistical Relationships in the Case of Automated Data Entry

(number of observations = 229)



* DE: Data entry

frequent are on the whole clerks whose tasks are almost exclusively related to data entry; their status is that of "temporary" employees and they work in pools.

An analysis of the statistical relationships points up the influence of the following variables on the perception of a lower frequency of health problems: involvement in making decisions concerning the implementation of computer technology, positive attitude toward technological change, work organized the way that of office clerks is, and individual workstations. Nonetheless, it can be seen that respondents with the most experience and those who spend most of their time doing data entry perceive there to be a higher number and frequency of health problems.

The management variables are more closely related statistically to the positive attitude of data entry operators toward computer technology. A satisfactory physical environment, involvement in making decisions concerning implementation, greater satisfaction with training received, and working conditions that decrease the number of health problems related to automation all seem to promote a more positive attitude toward computer technology.

These significant statistical relationships illustrate the importance of policies for managing the implementation of new technology as variables in explaining the satisfaction of data entry operators. The most satisfied respondents are those who perceive their physical environment to be appropriate and their health problems to be infrequent; they are also satisfied with the training they received and their involvement in making decisions concerning automation. Management policies related to employment (job title, number of hours per week spent using computers, and the organizational structure of the work) can also be seen to influence the degree of satisfaction. We also note that satisfaction

increases with age and the positive attitude of the workers toward computer technology.

3.2 WORD PROCESSORS

Among all respondents who used word processing equipment, those whose workstations are not grouped into a pool and those who spend the most time using word processing equipment each week perceive their tasks to be more varied.

The significant statistical relationships between the perceived level of complexity of the tasks and the other variables varies enormously from one organization to another. For all respondents, age and experience on the job are the only personal characteristics related to the complexity of the tasks: the youngest ones and those with the least experience on the job perceive the tasks to be less complex. At each individual organization, the characteristics common to respondents who perceive their tasks to be more complex are having less experience using word processing equipment and having individual workstations.

Statistical analysis shows that workers who perceive their work to be more strictly monitored are younger, have a certain amount of seniority on their job, hold positions as clerk-typists, work in pools, make heavy use of word processing equipment on a weekly basis, and received relatively long training on the word processing equipment when it was introduced. The nature of their tasks and status of their job are the variables most closely linked to the amount of monitoring of their work.

The youngest word processing operators, the clerk-typists and the women who work in pools have the most frequent social interactions. The frequency of social interactions decreases with age, the status of secretary and isolation at individual workstations.

Statistical analysis shows that personal characteristics are closely related to the attitude of word processor operators toward computer technology. The most positive attitudes are found among the youngest employees and those with the least experience on their jobs. Some management decisions may also influence the attitude of respondents toward computer technology. In fact, we note that employees with the most positive attitudes toward word processing equipment are those who perceive their office to be well suited, those who work in a pool and those whose rate of health problems is low. The statistical relationship between dissatisfaction with training and the more positive attitude of respondents may indicate that training received does not influence the attitude of respondents toward word processing equipment.

Health problems are perceived to be less numerous by users who feel that their furniture or office is satisfactory, those who are satisfied with the training they received, and those who have participated more in making decisions concerning the introduction of word processing equipment. Employees with the least experience using word processors, clerk-typists and women who work in pools perceive more health problems to be caused by computer technology. Involvement in making decisions concerning implementation, an appropriate physical environment and greater mastery of the technology gained through experience seem to be factors likely to decrease the number of health problems perceived to be related to the use of word processing equipment and also tend to be associated with a higher degree of satisfaction.

Satisfaction with word processing equipment is statistically more closely related to management decisions concerning the implementation of the technology. The most satisfied word processor operators are those who feel that their physical work environment is appropriate and that their training on word processing equipment was satisfactory, those who were most involved

in making decisions concerning the implementation of technological change, and those who perceive there to be a smaller number of health problems caused by computer technology. In general, respondents with a more positive attitude toward word processing equipment and those who use word processing equipment very frequently are the most satisfied.

Statistical analysis brings to light the important influence of personal characteristics and job characteristics as factors explaining the impact of data entry and word processing computer technology on human resources.

Involvement in decision-making and satisfaction with training received are related to positive attitudes and degree of satisfaction with computer technology. It is therefore important that when the technology is introduced and afterwards, managers involve the employees concerned and make sure that they are well-trained. We have seen that a few changes to working conditions, by encouraging a higher level of satisfaction among users and more positive attitudes toward computer technology, minimize the number of health problems perceived. In each organization studied, the changes made concerned almost exclusively the furniture and physical layout of the workplace.

Another concern of managers should be to develop and maintain a positive attitude toward the new technology among users. Workers have a more positive attitude toward technological changes when they perceive them as either a factor in improving their working conditions or as tools that make their jobs easier and increase the quality of their output. Awareness of the advantages and potential of the new technology is therefore essential if the organization wishes to promote the acceptance and co-operation of employees.

Training is an important variable in the satisfactory use of the new technology. The level of workers' satisfaction with their training directly influences their satisfaction with decisions concerning implementation and working conditions, and indirectly promotes a more positive attitude toward technological change. It is therefore important that managers be concerned not only with the quality of training given, but also more particularly with the relevance of the content of the training to the needs of users.

CONCLUSION

This study had two objectives: (1) to identify and assess the positive and negative effects of computer technology as perceived by operators of data entry terminals and word processing equipment, and (2) to determine whether management variables and the personal characteristics of workers were related to their perception of the impact of computer technology on the quantity and quality of their work. Some of our hypotheses were confirmed and others were not.

The findings of our research are generally in keeping with those of other studies of Quebec organizations. Depending on the technology and effects studied, the observations of our research generally confirm the positive and negative effects most frequently cited in the literature on the subject. They differ only concerning the impact on the variety of tasks and the quantity of word processing jobs.

Counter to the negative predictions in the literature, including some other studies (Benoit et al. 1984; Morissette & Desjardins 1985; Thibodeau & Julien 1945), our study found that the use of computer technology has thus far not caused a drastic drop in the number of jobs. Nonetheless, we note a gradual decrease in the number of data entry jobs, chiefly those involving data entry alone. These should disappear totally when organizations are fully automated.

In keeping with the conclusions of our preliminary research (David-McNeil et al. 1987), in this study we also observed a relatively high degree of diversity of the work of employees and a slight increase in the variety of tasks, as well as a high degree of satisfaction and a slight increase in the degree of satisfaction of respondents. Nonetheless, it should be noted that, generally speaking, these effects are more marked for word processor operators than data entry operators. Overall, these findings invalidate the conclusions of some studies, which have demonstrated

that computer technology, by accentuating Taylor's system, reduces the variety of work (Buchanan & Boddy 1982; Zuboff 1983). Nonetheless, they confirm the emergence of flexibility through the expansion and increase in the variety of tasks, as shown in more recent studies (Benoît et al. 1984; Diebold Group 1984; Morissette & Desjardins 1986; Pinard & Rousseau 1985).

The findings of this study, similar to those of our preliminary research, indicate that tasks carried out by users are moderately complex, and that this complexity increased slightly after the introduction of automation. The degree of satisfaction with the complexity of tasks is relatively high. Word processor operators' perceptions of aspects relating to the variety of tasks are slightly stronger than those of data entry operators. Generally speaking, the findings of our study confirm the conclusions of earlier research showing that the new requirements of jobs involving computer technology accentuate the complexity of the work done by the operators (Benoît et al. 1984; Morissette & Desjardins 1986).

Generally speaking, data entry operators perceive little change in their degree of autonomy. Word processor operators consider that they are more independent. As we found in our preliminary research, employees are highly satisfied with their degree of autonomy. These findings correspond to the positive or neutral effects found in recent studies demonstrating that independence remains unchanged or increases with the introduction of computer technology (Diebold Group 1984; Jacob et al. 1985; Morissette & Desjardins 1986; Rafaeli & Sutton 1986).

Observations made in this study indicate that the use of computer technology has not increased the intrafirm job mobility of users. Nonetheless, technological changes are perceived as factors more favourable to interfirm mobility than to intrafirm mobility, particularly among word processor operators. We also

noted a low degree of satisfaction with job mobility. These findings corroborate the conclusions of several studies that have demonstrated that users' chances for promotion within their organizations did not change at all (Bickson et al. 1985; Morissette & Desjardins 1986).

The results of this study show that data entry operators are more closely monitored. Monitoring of word processor operators increased slightly. These observations partially confirm the conclusions of earlier research indicating that the use of computer technology encourages increased monitoring of productivity and work standards of employees (Benoît et al. 1984; Morissette & Desjardins 1986; Rafaeli & Sutton 1986). In our research, we observed that computer technology was not used to reinforce monitoring policies.

We observed a relatively moderate frequency and intensity of health problems. After automation, the incidences of eyestrain, stress, headache and backache increased slightly. We note a dissatisfaction among respondents with respect to occupational health policies. These findings confirm the conclusions of earlier studies demonstrating the existence of health problems, the most frequent of which is eyestrain (Daindoff et al. 1981; Johansson & Aronsson 1984; Morissette & Desjardins 1986).

Generally speaking, the use of computer technology does not change the network of social interactions within the organization, which remain frequent after automation. Nonetheless, we note that social interactions among word processor operators are slightly more frequent after implementation, while those among data entry operators remain unchanged or decrease slightly. These observations have also been verified in recent studies that indicate that computer technology, in general, does not influence social interactions on the job (Comtois 1987; Diebold Group 1984; Morissette & Desjardins 1986) except in the sense of increased co-operation among word processor operators (Benoît et al. 1984).

The findings of this research invalidate those of our preliminary research, in which we demonstrated that workers in general had a moderately positive attitude toward computer technology after its introduction and that employees who had a marked attitude (whether positive or negative) at the time of introduction had a fairly positive attitude afterward. On the contrary, in this study we note that respondents have a positive attitude toward computer technology and that their attitude improved after automation was implemented. These observations partially confirm the conclusions of earlier research, which show that users are apprehensive when automation is introduced, but that these apprehensions fade as they become familiar with the technology (Collins & Moore 1983; Green 1983; Munoz 1985). In our study, not only do we see a positive attitude among workers at the time of implementation and afterward, but an increase in the number who have a positive attitude after implementation; this partially corroborates the findings of Comtois' study (1987), which demonstrated a positive, stable general attitude of workers at the time of implementation and a few months later.

Like the authors of other recent studies (Bickson, Stasz & Mankin 1985; Green 1983; Diebold Group 1984), we were able to conclude that users were satisfied with computer technology and their working conditions, and that their level of satisfaction in this respect increased slightly or rather significantly with the implementation of computer technology.

Some of the variables that influence the impact of computer technology on human resources have been verified, and others have been contradicted. The characteristics of individuals and jobs are closely related to all the effects identified, while the variables to do with management of the implementation of new technology had no significant statistical relationship with perceptions of health

problems, positive attitudes or satisfaction with computer technology.

Contrary to our expectations, despite their low rate of involvement in making decisions concerning the implementation of new technology, the absence of unions from the decision-making process and the lack of review of human resources management policies to adapt them to tasks modified as a result of technological change, the workers' satisfaction at the time automation is implemented and afterward increased slightly. There was therefore no drop in the level of satisfaction. We also note little change in the positive attitudes of respondents.

We chose to study the impact of data entry and word processing computer technology on human resources because the workers affected are almost exclusively women. Does our research lead us to conclude that office automation is a factor in improving the working conditions of women employed in offices?

According to our findings, the automation of data entry and word processing jobs constitutes technological progress, but not progress in the working conditions of office employees. The new technology has provided them with tools that make it easier to accomplish their tasks; they are unanimous in acknowledging that the new equipment is more powerful and more pleasant to use. All are satisfied with the decision to implement the computer technology that makes their job easier. Nonetheless, they deplore the fact that managers have not changed their working conditions to take into account the skills they have acquired, their increased productivity, and the improved quality of their output. These changes in human resources policy are particularly important in jobs where women are the majority, where job mobility is limited and pay is low.

This study shows how important management variables and personal characteristics are as factors influencing the impact of computer technology on employees' working conditions and satisfaction. The conclusions of this study are therefore closer to the views held by partisans of technological neutrality than to the ones held by those who believe in technological determinism.

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